

TOSS-UP

1. ASTRONOMY: Multiple Choice: At one point during 2002, which one of the following planets could NOT be seen very close to each other in the western sky?

- W) Mars
- X) Saturn
- Y) Mercury
- Z) Jupiter

ANSWER: X) Saturn

BONUS

1. ASTRONOMY: Multiple Choice: Stardust, CONTOUR and Deep Impact are among the recent spacecraft launched by NASA to study:

- W) comets
- X) meteors
- Y) asteroids
- Z) the Sun

ANSWER: W) comets

TOSS-UP

2. BIOLOGY: Short Answer: Removing nitric oxide from the body may cure this disease caused by pressure on the optic nerve. What disorder can be diagnosed by your ophthalmologist after blowing a puff of air into your eye?

ANSWER: glaucoma

BONUS

2. BIOLOGY: Short Answer: What general part of your body contains the zygomatic [zigh-ga-MAT-ick] bone?

ANSWER: face or head

TOSS-UP

3. MATH: Multiple Choice: What is the relationship between the complex numbers $(3 - 6i)$ and $(3 + 6i)$?

- W) additive inverses
- X) multiplicative inverses
- Y) opposites
- Z) conjugate pair

ANSWER: **Z) conjugate pair**

BONUS

3. MATH: Short Answer: His Conjecture in three-dimensional topology went unproven for nearly 100 years until Russian math professor Grigori Perelman announced he had proved it in 2003. Name this 20th-century French mathematician.

ANSWER: Henri **Poincaré** [pwahn-ca-RAY]

TOSS-UP

4. PHYSICS: Short Answer: What scientific principle states that the exact momentum and exact location of a particle can never be known at the same time?

ANSWER: **Heisenberg's Uncertainty** Principle

BONUS

4. PHYSICS: Multiple Choice: According to Heisenberg's Uncertainty Principle, the measurement error is always at least equal to what value?

- W) Hubble's constant
- X) Permittivity of free space
- Y) Rydberg constant
- Z) Planck's constant

ANSWER: **Z) Planck's constant**

TOSS-UP

5. GENERAL SCIENCE: Multiple Choice: What computer software included in the Microsoft Office package is called a "presentation graphics" program and often used to make overhead slides?

- W) Access
- X) PowerPoint
- Y) Project
- Z) Excel

ANSWER: **X) PowerPoint**

BONUS

5. GENERAL SCIENCE: Short Answer: This form of lily grows up to 40 feet tall--but only in California's Mojave [mo-HAH-vee] Desert. Identify this plant whose raised arms gave it the name of an Old Testament prophet.

ANSWER: **Joshua tree**

TOSS-UP

6. CHEMISTRY: Short Answer: Give the valence of chromium in the compound "chromic oxide", Cr_2O_3 .

ANSWER: **+3**

BONUS

6. CHEMISTRY: Short Answer: Give the valence of chromium in the compound "potassium dichromate", $\text{K}_2\text{Cr}_2\text{O}_7$.

ANSWER: **+6**

TOSS-UP

7. EARTH SCIENCE: Multiple Choice: The mineral called "malachite" [MAL-a-kite] is green because it contains what metallic element?

- W) zinc
- X) vanadium
- Y) iron
- Z) copper

ANSWER: Z) copper

BONUS

7. EARTH SCIENCE: Short Answer: They are caused by the interaction between the Earth's magnetic field and the stream of particles known as the "solar wind." Identify these two belts of ionized gas that circle the Earth and are named for an American physicist.

ANSWER: Van Allen belts

TOSS-UP

8. MATH: Short Answer: If the function $f(x) = x^4 - 6x^3 - 4x^2 + 8x - 6$, calculate the value of $f(x)$ at $x = 2$.

ANSWER: -38

BONUS

8. MATH: Multiple Choice: The volume in cubic inches of a right circular cylinder with radius and height both 10 inches is equal to:

- W) 100 pi
- X) 500 pi
- Y) 1000 pi
- Z) 2000 pi

ANSWER: Y) 1000 pi

TOSS-UP

9. BIOLOGY: Multiple Choice: Which of these sea creatures are contained in the phylum *Porifera* [pa-RIFF-a-ra]?

- W) sea cucumbers
- X) sponges
- Y) sea horse
- Z) sharks

ANSWER: X) sponges

BONUS

9. BIOLOGY: Short Answer: Give the term for the biological process that begins when a chemical makes algae grow so thickly in a river that sunlight is blocked from reaching the plants underneath the algae and ends when the plants die and can't be used as food for the fish.

ANSWER: eutrophication

TOSS-UP

10. CURRENT EVENTS: Short Answer: In 2004, the nations of Nigeria, India, Pakistan, Egypt, Afghanistan and Niger all signed an agreement to finish vaccinating their children against what disease whose first vaccine is credited to Dr. Jonas Salk?

ANSWER: poliomyelitis

BONUS

10. CURRENT EVENTS: Short Answer: Name the California lab whose founder Victor Conte was recently indicted on charges of illegal distribution of steroids, some of which may have gone to prominent athletes.

ANSWER: BALCO or Bay Area Laboratory Cooperative

TOSS-UP

11. ASTRONOMY: Multiple Choice: On what 1969 space mission did Neil Armstrong and Buzz Aldrin walk on the moon?

- W) Apollo 9
- X) Apollo 11
- Y) Apollo 12
- Z) Apollo 13

ANSWER: X) Apollo 11

BONUS

11. ASTRONOMY: Multiple Choice: In what U.S. state would you find the Keck Observatory?

- W) Hawaii
- X) California
- Y) Massachusetts
- Z) New Hampshire

ANSWER: W) Hawaii

TOSS-UP

12. GENERAL SCIENCE: Short Answer: In 2001, the British government announced plans to re-route traffic around it and move its visitors center two miles away. What landmark of southern England features a set of ancient rocks thought to have been used as a giant calendar?

ANSWER: Stonehenge

BONUS

12. GENERAL SCIENCE: Short Answer: Scientists once thought it was the part of a combustible substance that was released by burning it. What substance was finally proved nonexistent by French chemist Antoine Lavoisier [la-vwah-zee-AIR]?

ANSWER: phlogiston [fla-JIS-tun]

TOSS-UP

13. CHEMISTRY: Short Answer: It is found in the compound dolomite [DOUGH-la-mite], and its hydroxide can serve as an antacid. Name this flammable metal whose hydrous sulfate form is often called "Epsom salts."

ANSWER: magnesium

BONUS

13. CHEMISTRY: Short Answer: Named from the Greek for "bearer of light", it was discovered in the mid-1600s while looking for the famed Philosopher's Stone. What chemical element has a name in Spanish that sounds very much like the Spanish word for "matches"?

ANSWER: phosphorus ("fósforos")

TOSS-UP

14. PHYSICS: Short Answer: An electrical transformer's primary winding has 100 turns and puts out 20 volts. Give the voltage on the secondary winding if it contains 800 turns.

ANSWER: 160 volts

BONUS

14. PHYSICS: Multiple Choice: For this same transformer, 1 ampere of current runs through the primary winding while generating the 20 volts. How much resistance is on the secondary winding?

- W) 20 ohms
- X) 160 ohms
- Y) 640 ohms
- Z) 1280 ohms

ANSWER: Z) 1280 ohms [160 V / 1/8 A]

TOSS-UP

15. MATH: Short Answer: Matrix A has a top row of 6 and 9 and a bottom row of -4 and -5. Matrix B has a top row of 3 and 2 and a bottom row of -3 and 1. Give the value of the top left element in the product $A \times B$.

ANSWER: -9

BONUS

15. MATH: Short Answer: If you're riding your bicycle at 10 miles per hour, how fast are you going in "furlongs per fortnight"? Note that 8 furlongs equal 1 mile and a fortnight equals 14 days.

ANSWER: 26,880 furlongs per fortnight ($10 \times 8 \times 24 \times 14$)

TOSS-UP

16. BIOLOGY: Short Answer: It won Swiss entomologist Paul Mueller the 1939 Nobel Prize in Medicine for its discovery. Though still used to treat mosquitoes, it was banned in Canada and the U.S. in the 1970s partly because it thins the shells of bird eggs. Give the three-letter abbreviation for this insecticide.

ANSWER: DDT

BONUS

16. BIOLOGY: Short Answer: Taro root, yams and cassava [ka-SAW-va] all fit into what class of starchy edible plant that also includes truffles and potatoes?

ANSWER: tubers

TOSS-UP

17. EARTH SCIENCE: Short Answer: What is measured in Roman numerals on the Mercalli scale and in decimals to the nearest tenth on the Richter scale?

ANSWER: earthquake intensity

BONUS

17. EARTH SCIENCE: Short Answer: Pleistocene [PLY-sta-seen], Miocene [MY-a-seen], and Holocene [HO-la-seen] are all names to describe--what unit of geologic time that is shorter than a period?

ANSWER: epoch

TOSS-UP

18. GENERAL SCIENCE: Short Answer: One example of it in geology is that younger rock is found on top of older rock. Name this principle used in physics to mean that the total effect of two voltage sources on an electric circuit is equal to the sum of the individual effects of the two sources.

ANSWER: superposition

BONUS

18. GENERAL SCIENCE: Short Answer: Between 1811 and 1816, he led groups of workers to destroy the large machinery that was putting thousands of them out of work. Identify this Englishman whose name is still used today to describe people who have a fear or hatred of new technology.

ANSWER: Ned Ludd (accept Luddites)

TOSS-UP

19. CHEMISTRY: Multiple Choice: The Bronsted-Lowry theory divides compounds based on whether they donate or accept:

- W) neutrons
- X) electrons
- Y) quarks
- Z) protons

ANSWER: Z) protons

BONUS

19. CHEMISTRY: Short Answer: Its pure, or "glacial", form solidifies at about 62° Fahrenheit. When diluted, it is sold in supermarkets as "vinegar." Name this sour-tasting acid with formula CH_3COOH .

ANSWER: acetic acid (or ethanoic acid)

TOSS-UP

20. MATH: Short Answer: Let $z = x^2y^2 + 2x^2y + 2xy^2 + 3x + 4y - 6$. Calculate the partial derivative of z with respect to x .

ANSWER: $2xy^2 + 4xy + 2y^2 + 3$

BONUS

20. MATH: Short Answer: Given the same equation for z , calculate the second partial derivative of z with respect to y .

ANSWER: $2x^2 + 4x$

TOSS-UP

21. CURRENT EVENTS: Short Answer: Trim Spa, Ripped Fuel, Speed Stack, Thermadrine and Xenadrine [ZEN-a-dreen] are all nutritional supplements that contain what substance banned by the FDA in 2003?

ANSWER: ephedra or ma huang

BONUS

21. CURRENT EVENTS: Multiple Choice: What type of animal did scientists clone at Texas A&M in December 2003 and name Dewey?

- W) a sheep
- X) a deer
- Y) a pig
- Z) a pelican

ANSWER: X) a deer

TOSS-UP

22. MATH: Short Answer: In any given mathematical region, what is the minimum number of colors needed to make sure that sub-regions with the same color don't touch each other?

ANSWER: 4

BONUS

22. MATH: Multiple Choice: What Greek letter is assigned to the irrational number approximately equal to 1.618, sometimes called the "golden ratio" ?

- W) phi
- X) omega
- Y) gamma
- Z) sigma

ANSWER: W) phi

TOSS-UP

23. BIOLOGY: Multiple Choice: What scientist is credited as the first to observe protozoa, red blood cells, and bacteria?

- W) Galileo Galilei
- X) William Jenner
- Y) Anton van Leeuwenhoek [LAY-vun-hoak]
- Z) Luigi Galvani

ANSWER: Y) Anton van Leeuwenhoek

BONUS

23. BIOLOGY: Short Answer: It metabolizes carbohydrate, and synthesizes proteins and lipids. Name this cell transport system whose rough type contains ribosomes and whose smooth type does not.

ANSWER: endoplasmic reticulum (or E.R.)

TOSS-UP

24. PHYSICS: Multiple Choice: Each of the 6 "flavors" of quarks has three possible "colors." Which of the following is NOT one of those three colors?

- W) yellow
- X) red
- Y) blue
- Z) green

ANSWER: W) yellow

BONUS

24. PHYSICS: Short Answer: The specific heat of aluminum is 0.9 joules per gram degree Celsius. How much heat in joules must be added to a 1.4-kilogram mass of aluminum to increase its temperature from 10 degrees Celsius to 40 degrees Celsius?

ANSWER: 37,800 J or 37.8 kJ ($0.9 \times 1400 \times 30$)

TOSS-UP

25. CHEMISTRY: Multiple Choice: What capital letter usually represents the equilibrium constant?

- W) E
- X) K
- Y) R
- Z) V

ANSWER: X) K

BONUS

25. CHEMISTRY: Short Answer: What adjective describes alcohol that has had material added so it is unfit for drink and therefore safe for use in chemistry lab experiments?

ANSWER: denatured alcohol

END OF ROUND 5